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Students approaches to learning anatomy: students' experiences and relations to the learning environment.

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Approaches to learning anatomy

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To examine students' perceptions and experiences of learning anatomy, an on-line Likert style questionnaire was administered during 2006 to students reading a Bachelor of Medicine four and five year programme (n=256, 23.8%). Statistical analysis found that students predominantly felt that understanding anatomy and working with human cadaveric material were very important in becoming a doctor. Students reported that working on cadaveric specimens was an effective way of learning anatomy, but also found the amount of anatomy they needed to learn daunting. Student responses were correlated with their approaches to learning (ASSIST) scores using a Kruskal Wallis test. Significant relationships between the approach to learning anatomy adopted and students' perception and experience of anatomy were found. A deep approach to learning anatomy correlated with students who reported that the most effective way of learning anatomy in the dissecting room was to get their hands in and feel for structures, used anatomical terms and language at clinical opportunities, and frequently used their anatomy radiology knowledge at clinical opportunities. A surface approach to learning anatomy was associated with elements such as students finding anatomy learning daunting and not seeing the point to it. The outcomes provide clear associations between students' perception of the anatomy learning environment, the approach adopted and the anatomy activities students engage in. The findings highlight that understanding and applying anatomy knowledge is best accomplished by the adoption of a deep approach.

Approaches to learning
Learning anatomy
Anatomy education

A significant contribution to the educational understanding of how students go about learning was made by Marton and Saljo (1976). They used the term 'approach to learning' as the way of going about a learning task in context. There are three different ways a student may go about a learning task (Newble and Entwistle 1986). Students adopt either a deep, strategic or surface approach to learning based on their perception of the learning environment (Prosser and Trigwell 1999). Students who adopt a deep approach do so because they want to go about the learning in a meaningful way (Biggs 2003) and to understand the material or subject (Newble & Entwistle 1986). Students are motivated by their interest in the subject (Newble & Clarke 1986) and utilize previous knowledge and experience to examine evidence of a new concept (Newble & Entwistle 1986). The use of a deep approach is related to high quality learning outcomes (Trigwell & Prosser 1991). Students who adopt a strategic approach are influenced by the context; they will use whatever approach they perceive will get them high grades (Newble & Entwistle 1986). These students therefore need to have versatility to use each approach as appropriate (Newble & Clarke 1986). Students who adopt a surface approach also adopt rote learning (Entwistle & Smith 2002), where the focus is on memorisation of information and ideas in isolation (Newble & Entwistle 1986). Students who adopt a surface approach are motivated by the fear of failure (Newble & Entwistle 1986).

This area of research has demonstrated that the approach to learning a student adopts is related to the quality and quantity of the learning that occurs. In the case of professions that require application of anatomy knowledge the outcome of learning is related to the professional care given to a patient. The study

reported in this paper set out to investigate how students were approaching anatomy learning and their experiences of learning anatomy, so that the educational concept of approaches to learning could be better defined in the context of anatomy education.

The case study of the University of Southampton was selected for this study. Students on the Bachelor of Medicine four and five year (BM4 and BM5) course were invited to take part. The four year course is a graduate entry course which utilizes a mixture of problem based and case based learning. The five year course is system based. Anatomy curricular activities include lectures, tutorials and practicals involving prosected specimens in the first two years. In the third and fourth years students can participate in a Special Study Unit and/or Project in Depth which involves cadaveric dissection.

MATERIALS AND METHODS

As detailed in Smith and Mathias (2007) permission was obtained from the Enhancing Teaching and Learning Project, University of Edinburgh, to use the Approaches to Studying Inventory for Students (ASSIST) and to add in the word 'anatomy' where applicable. A Likert scale questionnaire was developed in six clusters to explore: the activities students prefer to do to learn anatomy, students' experiences and feelings about working on cadavers, the problems students encountered in learning anatomy, how students currently use their anatomy knowledge, students' overall perceptions of anatomy, and a few questions specific to either the early or later years of the course. A detailed list of questions can be seen in Table 1.

The ASSIST inventory and questionnaire were written in Questionmark Perception™ and were hosted on University servers. In line with the Central Office for Research Ethics Committees Approval (05/Q1704/147) in 2006 students on the BM 4 and 5 courses (all years, 1075 students) were emailed an invitation to participate in this study (44 emails were returned as undeliverable). Students were asked to read and complete the Participant Information Sheet and consent form. Students were then guided through the ASSIST inventory pages followed by the questionnaire. Students who had fully completed the questionnaire were entered into a prize draw for book tokens.

RESULTS

Data were removed from the server and were cleaned to ensure correct formatting. Any entry which was incomplete was deleted. Table 2 provides details of the sample for the ASSIST Inventory and Questionnaire. The sample contained nineteen students from a potential 79 (24.1%) from the BM 4 course and 243 from a potential 996 (24.4%) from the BM 5 course. Overall the sample contained 44 mature students and 24 overseas students.

To gain an overall understanding of the questionnaire responses graphs were created for each question in Statistical Package for the Social Sciences (SPSS). A clustered bar chart technique illustrated student responses to the Likert scale questions alongside the year of study to facilitate comparison. ASSIST inventory scores were calculated as detailed in Entwistle (2006), to provide each student's dominant approach to learning anatomy.

Overall trends

Cluster 1 highlighted that students highly rated learning activities which involved textbooks, online material and course books. The use of textbooks and course materials may reflect the students' perceived need for learning in text form and as a reference. Students would be familiar with online learning and may have responded positively due to its flexibility in terms of time to help their learning.

Cluster 2 explored students' perceptions of working on cadavers. Importantly, students found working on specimens an effective way of learning anatomy (Figure 1). This may be explained further in that across all years students responded by strongly agreeing to getting their hands in and exploring a specimen and this may be linked to a touch-mediated perception process that occurs and which facilitates understanding (Figure 2).

Cluster 3 explored the problems that students encountered in anatomy. Aspects that students had problems with included: the amount to learn being daunting (Figure 3), exploring specimens with their hands, radiology, and remembering aspects covered in previous courses/years. In asking students about their primary motivation for learning, interestingly, although not statistically significant, a higher number of students in the 3rd and 5th years reported examinations as their motivation (Figure 4). This supports the findings of the ASSIST inventory (Smith and Mathias 2007) where it was found that more students adopted a strategic approach in the 3rd and 5th years of the BM 5 course. This perception

reflects real increases in assessment load during the course in the 3rd and 5th years (intermediate and final exams).

Cluster 4 began to explore how students were using their anatomy knowledge. In exploring the application of anatomy, students' perception of surface anatomy was the same across all years whilst their perception and use of radiographic anatomy were greater by the later years of the course. This illustrates the application of anatomy and the need to construct meaning in the context of anatomy. It also possibly relates to the need for students to transform their three-dimensional understanding of anatomy into new forms.

Cluster 5 asked students about their overall perception of anatomy. Importantly, in response to 'I feel that understanding anatomy is a very important part of becoming a doctor' (Figure 5), it is clear that many students agreed with this. This was further extended in the question 'I feel that working with cadaveric material is an important part of becoming a doctor' (Figure 6).

Cluster 6 contained a few questions that were specifically designed for either the early or later years of the course. Interestingly and not unexpectedly responses illustrated how in hindsight students' opinions of anatomy's relevance had increased as the course progressed.

Questionnaire response and approach to learning

In comparing the ASSIST preferences and students' responses to the questionnaire for both the BM 4 and 5 courses a Kruskal Wallis test was

performed to examine the relationship between a student's ASSIST preference and their responses to the Likert scale questions. Only those of significance are reported in Table 3.

The outcomes of this analysis provided a clear indication of some of the characteristics of each learning approach. Students who adopted a deep approach to learning anatomy responded more than those using other approaches that getting their hands in and exploring a specimen were important. Such an activity appears to be important in forming links that enable understanding and spatial ability. This touch-mediated perception may form an essential part in the true understanding of the human form. Evidence of the holistic nature found in a deep approach came across in anatomy learning with elements of understanding anatomical language and using radiographic knowledge at clinical opportunities. A deep approach establishes an understanding of the setting and aspects not overtly examined, as well as the future application of the knowledge.

Students who adopted a strategic approach rated the course material highly. This is not surprising as the course material contains specific information that defines the breadth and depth of the assessment. Students who adopted a strategic approach may not get a complete understanding from this but they know what they need for assessment, reflecting the trade-off between a deep and surface approach. It is also not surprising that they responded positively to working in groups, and sharing and confirming information. In applying knowledge, students who adopted a strategic approach felt they had to use the knowledge quickly.

This may be a strategy for 'use it or lose it' and testing which parts of the knowledge were needed and which were not.

Students who adopted a surface approach to learning anatomy felt that the amount to learn was daunting. They also did not see the point to learning anatomy and this related to their approach and the attitude of 'just remember it', reflecting the findings of Pandey and Zimitat (2007). Students who adopted a surface approach also felt that the teaching methods did not suit them, possibly reflecting a responsibility away from them and onto the teacher. Students who used a surface approach also reported that they learned to pass exams and that learning by memorisation was difficult. This often resulted in them responding that they often forget the details later. Later this finding was supported by their lack of confidence in their knowledge base. These characteristics are very much supported in the literature on learning approaches and can now be related to anatomy learning.

Year of study and response to questions

To explore the journey of learning anatomy as students began to apply their knowledge in the clinical context Pearson's Chi square tests were performed (and confirmed by Kruskal Wallis (KW) test and a Jonckheere-Terpstra (JT) test) to explore associations between the year of study and the Likert responses to questions. Significant differences were found between the year of study and the students' responses to the questions. The relationships which were significant are reported in Table 4.

Table 4 illustrates the possible transition of anatomy learning, with students in the second year of the course rating textbooks higher. The increase in the preference for mock exams in the fourth year supports the earlier findings (Smith and Mathias 2007) of an increased assessment motivation and strategic approach adopted by students. The table reflects problems encountered by students as they started to enter the more clinically-orientated years of the course. The application of anatomy is represented through radiology by later year students.

Gender and response to questions

Having found a relationship between gender and the approach to learning anatomy adopted (Smith and Mathias 2007), Mann Whitney tests were performed to explore the relationship between a student's Likert scale response to a question and their gender. Table 5 illustrates the significant responses.

Table 5 demonstrates and supports the findings of the ASSIST inventory regarding gender. Female students were reflecting aspects which related to a strategic approach to learning anatomy and male students to aspects concerned with a deep approach.

DISCUSSION

The anatomy questionnaire results in this exploratory case study helped to place the results of the approaches to learning inventory into context. The questionnaire ascertained students' perceptions of anatomy and reflected the

importance of anatomy and the use of cadavers in medicine. This is also the view supported by much of the literature.

In relating the ASSIST inventory to the questionnaire, links were seen between student perceptions, learning activities, influences and the approach to learning that students adopted. This suggests that there may be causal links. In particular, students who adopted a deep approach to learning anatomy reported highly on aspects such as exploration, holistic approach, not being driven by facts, and using the language and radiological knowledge at clinical opportunities. This may illustrate that a deep approach is related to the application of knowledge, such as in radiology. Exploration and application of anatomy also reflects an understanding of the three-dimensional form and a deep approach may facilitate this.

The aspects which promoted learning (e.g. enjoyment, confidence, relevance, and the use of radiographic anatomy) are of interest as these increased as the course progressed and are related to a deep approach. In exploring the learning environment and learning activities across years, all students felt that the following were important for their learning of anatomy: learning on human cadavers, learning through text books and course handbooks, learning through mock examination, online material, group learning, anatomical language and learning other things, e.g. natural variation and clinician-based teaching. It was not clear what made these important and further discussion with students would explore this. Despite this, problems with knowledge and confidence also emerged as the course progressed and further exploration is needed to look at

the elements that are detrimental to learning anatomy. How students were applying anatomy appears to be through the use of radiology in particular and further exploration of this is required to understand how anatomy knowledge is reconstructed for clinical practice.

However, the findings show statistical associations rather than causal relationships, so further qualitative investigation is needed to try to establish what factors were giving rise to each learning approach and whether any could be influenced in the design and teaching of anatomy. Nevertheless a deep approach should be encouraged by the curriculum and involve learning anatomy through human cadavers to allow for effective learning and application of anatomy in clinical practice. In addition, a deep approach to learning may be fostered through the appropriate design and placing of assessments, and the incorporation of more active learning activities and especially those which encourage the application of anatomy (e.g. as in radiology). It is also important to decrease those factors which promote a surface approach, such as assessments which require simple recall and rote memorization.

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